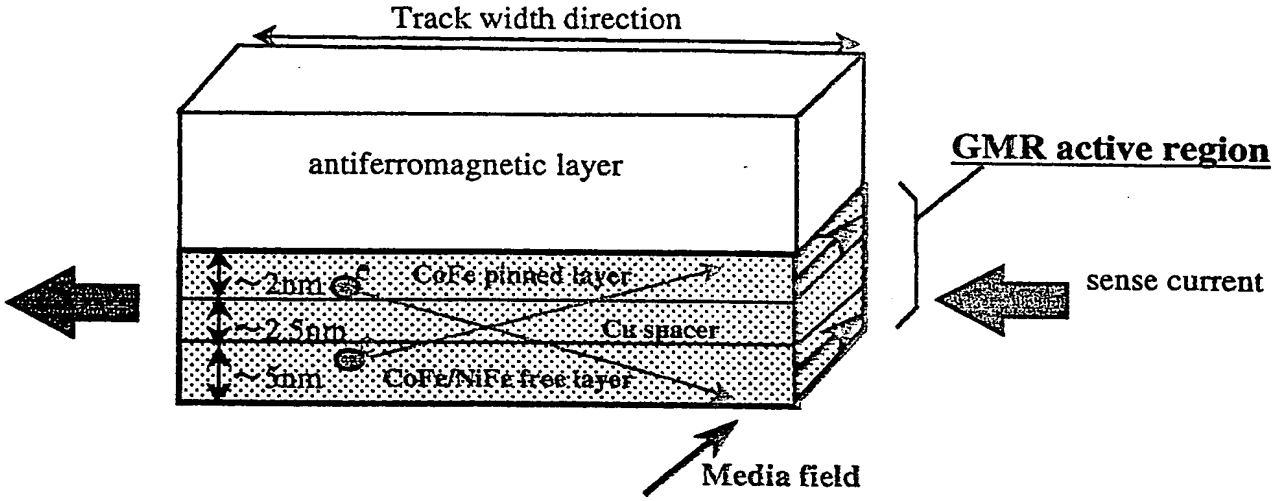
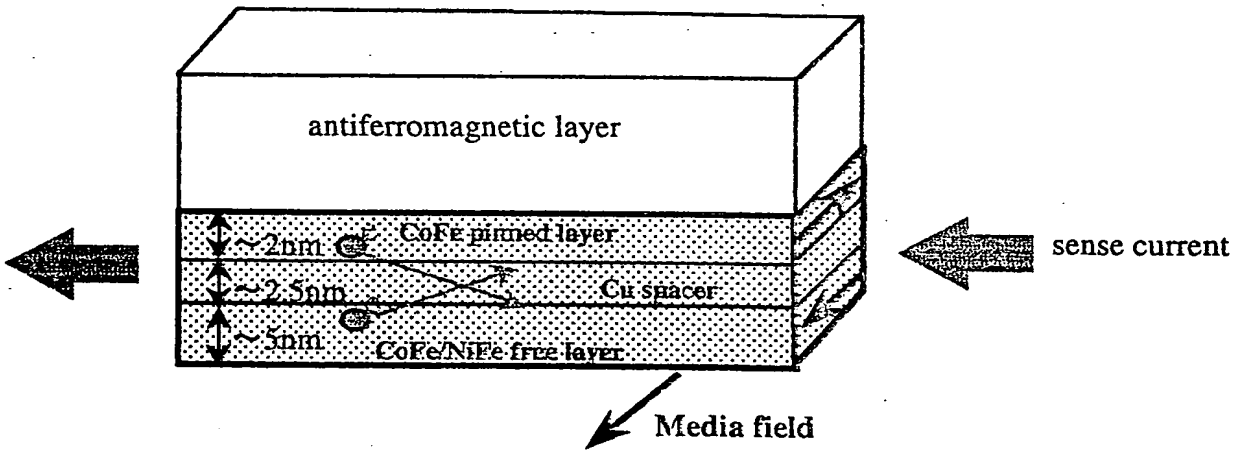
Mechanism of Spin Valve GMR



Low resistance state (parallel magnetization alignment)

Electron mean free path : Long
(No electron scattering at the pin/spacer and free/spacer interfaces)

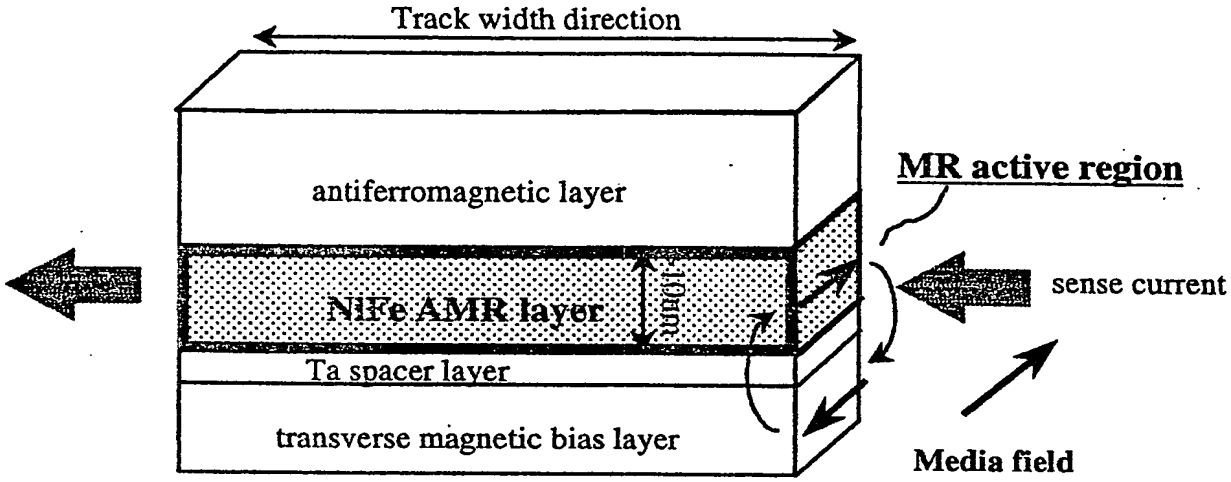


High resistance state (antiparallel magnetization alignment)

Electron mean free path : Short
(electron scattering at the pin/spacer and free/spacer interfaces)

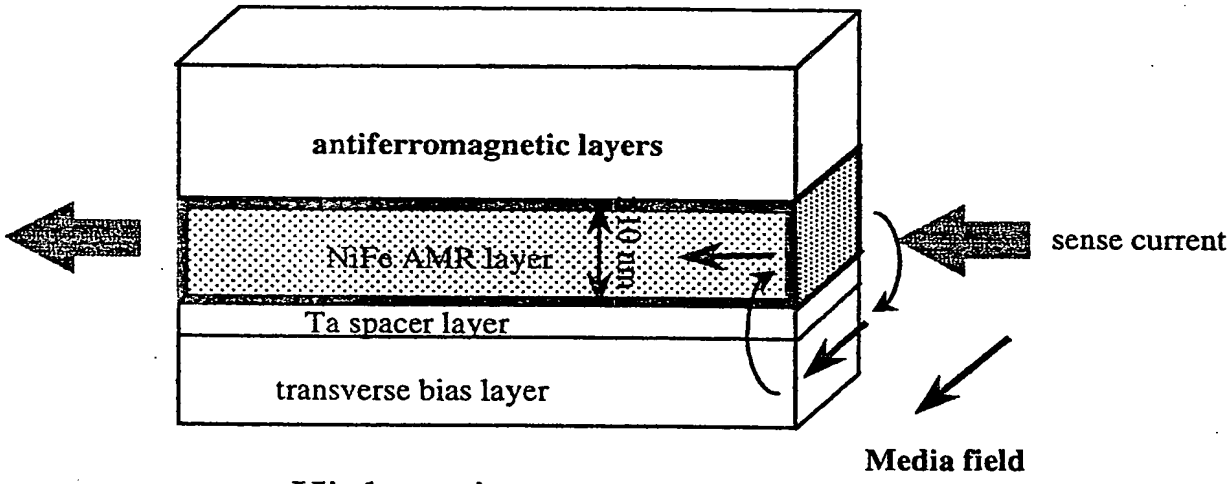
Spin Valve Giant Magnetoresistive Effect:
* MR appears by magnetization angle change between pinned and free layers separated by Cu spacer.
* MR ratio markedly depends on structure at pin/spacer and free/spacer interfaces.

Mechanism of Anisotropy Magnetoresistance (AMR)



Low resistance state

sense current direction ⊥ magnetization direction



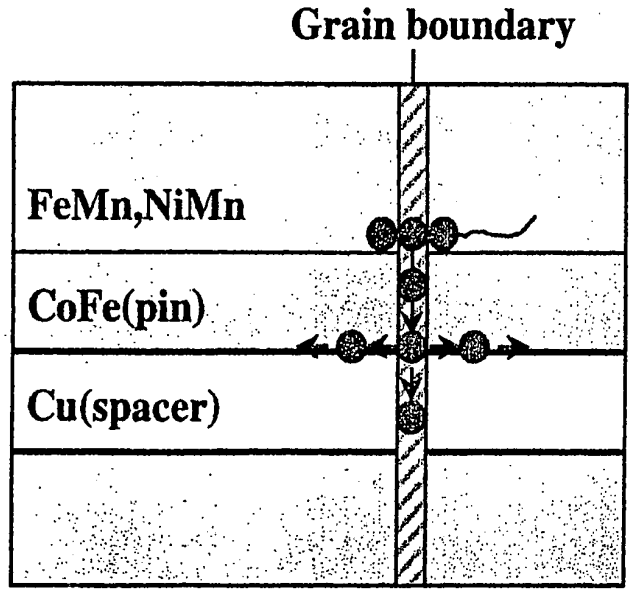
High resistance state

sense current direction // magnetization direction

Anisotropy Magnetoresistive Effect:

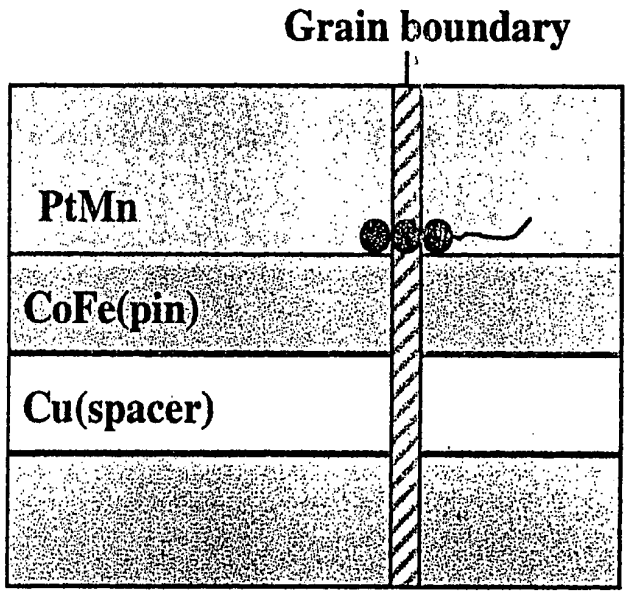
* MR appears by magnetization angle change between AMR magnetization and sense current directions.
* Ta spacer is only used in order to cut the magnetic coupling between AMR and transverse bias layers. (No influence on MR ratio)
* Transverse bias layer is only used in order to apply bias magnetic field to AMR layer. (No influence on MR ratio)

Relation between Mn diffusion and MR ratio deterioration



Mn diffusion
at the pin/spacer interface
→ MR ratio decreases.

(a) FeMn,NiMn Spin Valve



No Mn diffusion
at the pin/spacer interface
→ High MR ratio maintains.

(b) PtMn Spin Valve